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THE "ALAAS" AND THE STOCK FARMING IN YAKUTIA

A sub-arctic pastoral system based upon cryogenic wetlands

Selleron G., Métailié J.-P. University of Toulouse, GEODE-CNRS, France

The agriculture of Yakutia (Sakha republic) is characterized by a breeding of cows and horses in extreme climatic conditions. The pastoral zones are located between 60°N and 65°N, in an area of Siberia with very strong continental subarctic climate. At Yakutsk (62° 05' N, 129°45'E; 103 m a.s.l.), the mean annual temperature is -10.0°C, and mean monthly temperatures in January and July are -41.2°C and 18.7°C, respectively. Mean annual precipitation is 237 mm (National Astronomical Observatory, 2001), of which 150mm in summer.

Permafrost is present in all the territory and thickness can reach 500 m. near Yakutsk ; in central Yakutia the melting of permafrost in summer can reach a depth of 2-3 meters in sunny conditions, but only 50 cm in cold places (northern expositions and under forests). The geology of centra Yakutia is mainly of quaternary loess deposits covering the alluvial terraces of Lena and Aldan rivers.

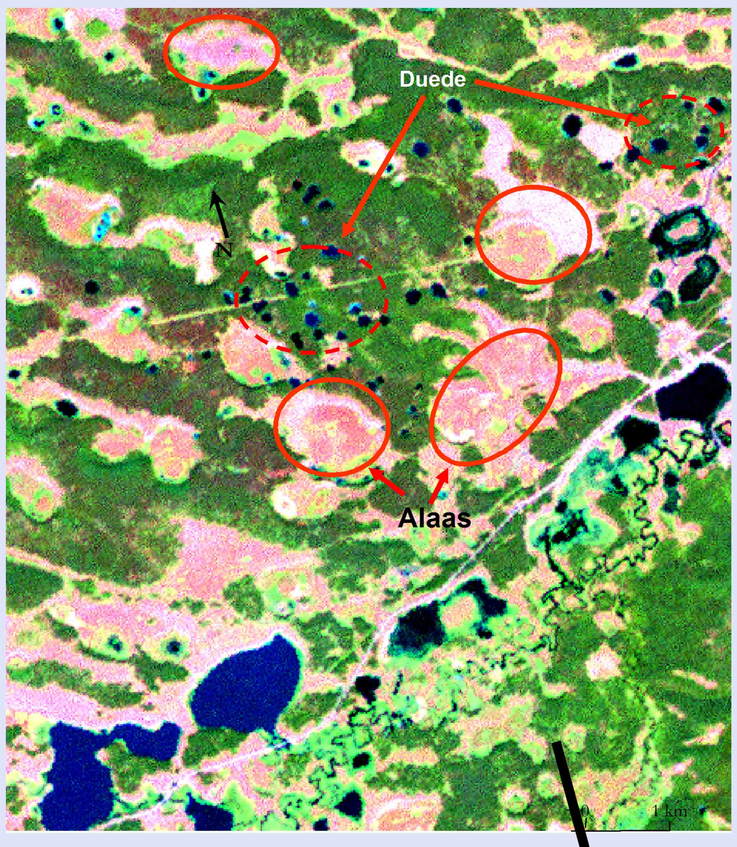
Yakustk : meteorological data

monthes	Jan	Fe	Mar	Ap	Ma	Jul	Jul	Aug	Sep	Oct	Nov	Dec	Year
Maxima (°C)	-6	-2	8	21	31	35	38	35	27	21	3	-4	38
Mean maximal temperature (°C)	-40	-31	-14	0	12	22	25	22	12	-4	-24	-37	-6
Mean annual temperature (°C)	-41	-36	-22	-6	7	15	19	15	6	-9	-29	-39	-8
Mean minimal temperature (°C)	-46	-41	-30	-14	0	8	12	9	1	-12	-33	-43	-15
Minima (°C)	-63	-64	-55	-41	-18	-7	-2	-8	-14	-41	-55	-60	-64
Mean rainfall (*mm*)	9	4	6	10	18	37	39	37	29	20	16	12	240

Source : Pogoda.ru.net

The vegetation of alaases is closely dependent of thermokarstic morphology and climatic conditions; the presence of lakes and stagnant water, and the fluctuation of the water level create concentric zones of herbaceous vegetation : in the center of the alaas or around the lakes, temporary marshes dominate with Carex and Scirpus ; a second ring corresponds to the rich meadows which can be mown and provide the great quantity of hay necessary for the winter. In the peripheral parts, the soils are dry and saline, and the vegetation is dominated by the Artemisia steppe, which can be only grazed. In the sunny woods of larch (Larix Gmellinii) and birches, the cattle can also find some grass in the underwood and in the burned stands ; on the opposite, in the northern exposures and in the dense forests, the permafrost remains superficial and the soil is covered only by lichens.

LANDSAT-ETM 2001 ("pseudo true colors")
Dark blue : deep waters of the duede and lakes. Light blue: surface waters
Dark pink : wet pastures. Clearly pink: dry pastures and steppe.
Light green : marshes. Dark green: Larch woodlands



A "duede" : the first stage of alaas morphological process

The *alaases* are thermokarstic depressions distributed throughout the central Yakutia. They are formed by thermal disturbance of the ice-rich permafrost surface and an increase in depth of the active layer (annually freezingthawing layer). The alaases, of circular forms, range in size from ca. 0.1 to 20 km in diameter, and 3 to 20 m in depth ; the first stage of alaas process, a very active small lake depression, is locally named *duede*. The duede are very numerous in the forest areas. In the lowland of central Yakutia, approximately 20% of land area is covered with alaases but the density is very variable.

Steppe on dry and saline soils with Artemisia jakutica
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A good meadow mown with the traditional yakut forgery
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Burned larch forest colonized by Epilobium angustifolium
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On the foreground: wet meadow with Agrostis trini
This type of meadow correspond to the area of water level fluctuation
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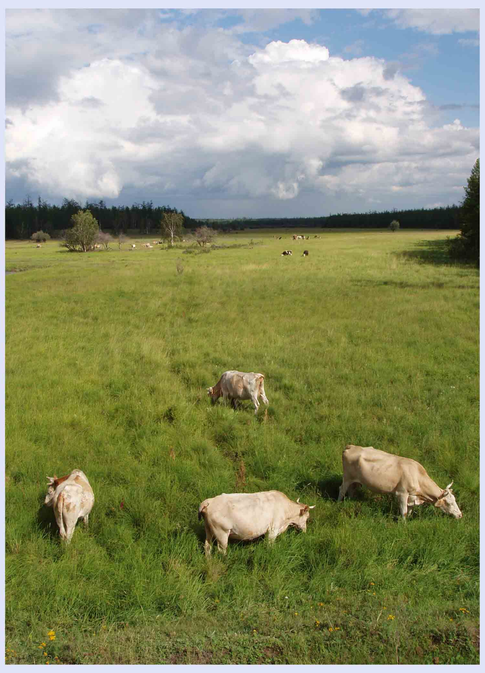
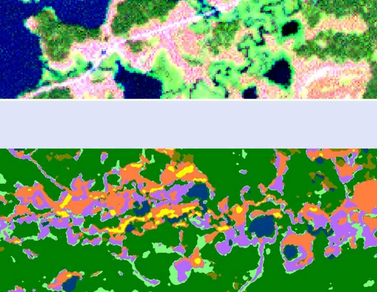
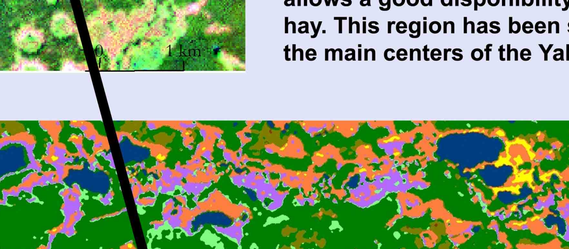
Marshes with Sholocloa festucacea

Sakhas, or Yakuts, are stockbreeders of horses and cows ; they are of Turco-Mongolian origin and would have colonized Yakutia during the Middle Ages, towards XIVth-XVth centuries, by transplanting a stockbreeding adapted to less cold areas. From central Yakutia, they colonized more septentrional areas (Vilyui, Verkhoiansk), probably during 17th and 18th centuries. Traditionnaly, yakut stockbreeding is based upon stabulation of the cows during the long and very cold winter (8-9 monthes), and summer transhumance at short distance in the nearby pastures. The horses, very robust, stand outside during winter.
Untill the Revolution, the yakuts lived in family hamlets in the middle of the pastures of the clan. The summer habitat was a "tepee" of birch bark. During the soviet period, they were gathered in kholkozes and sovkhozes, with great collective cowsheds and rustic Yakut cows were replaced by imported races (Simmental, Holstein) . Agriculture and ploughing were intensified in the dry parts of the alaases and terraces, causing the degradation of the fragile soils. From the fall of communism, the yakuts reconstituted family farms in the villages and the alaases were allotted according to the number of family members. The interannual fluctuation of water level in the alaases does not allow the precise delimitation of an exploitable surface.



Hay storage and insulated cowsheds ("xhoton") in yakutian village





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Because of this connection between thermokarstic process and dynamics of the vegetation, it is probable that the fodder resource of the alaases preexisted on arrival of the first Sakhas. One can make the hypothesis that the presence of this resource was one of the factors of the installation of these stockbreeders, which transported their cattle of regions distant from several thousands of kilometers. Indeed, the principal areas of historical Sakha settlement (like the valley of Taata river, 100 km in the east of the Lena) are characterized by the abundance of the alaases and the associated pastures.
However, the studies attest of an increase in herbaceous vegetation during the last centuries, showing an impact of the yakut stockbreeders and an extension of the pastures in the surroundings of the natural alaases.

In the valley of the Taata river, the classification of the Landsat image show the great number and extension of the alaases, which allows a good disponibility of meadows and hay. This region has been still today one of the main centers of the Yakut stockbreeding.